

Are LED Replacement Lamps Ready?

BY JAMES BRODRICK

Back in August, this column offered some CALiPER quick facts from recent testing of commercially available LED T8 replacement lamps. CALiPER results showed that the LED products tested did not achieve the lumen output or efficacy levels of the linear fluorescent lamps they claim to replace.

Market interest in replacement lamps is high, as many users look for LED products that they can simply plug into existing fixtures. In reality, it is often not that simple. A number of LED replacement products aim to take advantage of the directional nature of LEDs by packaging them in reflector lamp configurations (and some do it better than others). Some applications, like linear fluorescent lighting, traditionally use *non*-directional sources that emit light in all directions and rely, in part, on the fixture to redirect the light in a useful direction. Many users look to LEDs for a superior solution in such applications, but in the case of the LED T8 products tested, results indicate that most buyers today would be disappointed.

Is there cause for concern? In a word: yes. First impressions are lasting impressions, and none of the LED T8 products tested in CALiPER Round 5 performed as well as their fluorescent counterparts, or as

well as their manufacturer claims. It is difficult to gauge if inaccurate manufacturer claims are deliberate, or simply reflect a lack of understanding of the fundamental differences between traditional lighting technology and solid-state lighting (SSL) technology. Either way, it is a recipe for damaging a growing, but still fragile, new market.

COMPARING T8s

Round 5 of CALiPER testing included a focused series of tests on 4-ft linear LED lamps that are marketed for use in troffer housings to replace 4-ft linear fluorescent lamps. The product claims for the LED replacements were compelling:

- “Uses 2/3 less electricity than a

standard fluorescent tube light”

- “100,000 hours”
- “Emits light like a conventional T-series fluorescent light”

But CALiPER testing showed that these claims are exaggerated and misleading. Four LED T8 products were selected for testing, along with one typical T8 and one typical T12 fluorescent product. Two samples of each product were tested as bare lamps and then installed in typical troffers for in situ testing. **Figure 1** shows the in situ light output and efficacy of each pair of products tested. A considerable range of performance was observed across the four different LED products, with nearly a three-fold difference in output and efficacy between the lowest and highest performing LED products. Note that the LED products did not provide even 50 percent of the light output of the fluorescent systems. The LED products also demonstrated lower efficacy levels—one LED product had only one-third the efficacy of the fluorescent lamps.

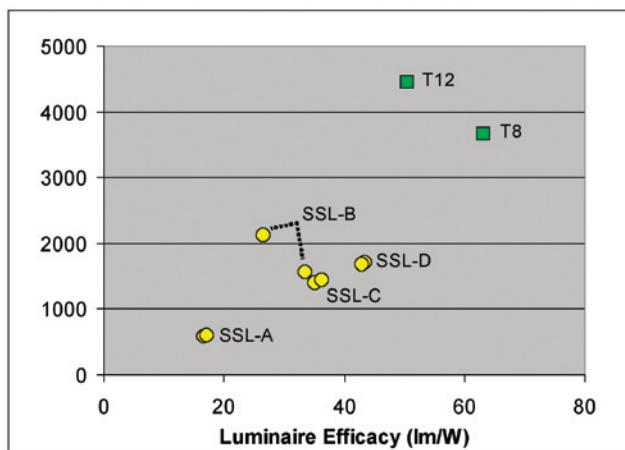


Figure 1. CALiPER Testing of Linear Replacement Lamps (in situ)

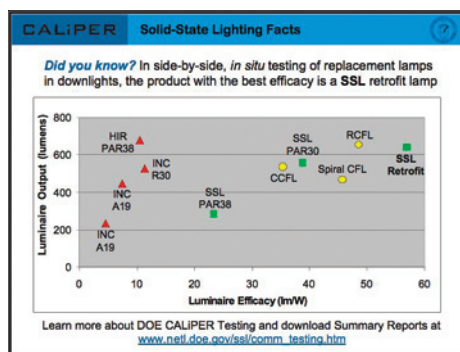
Source: Test Results for Linear Replacement Lamps, U.S. Department of Energy CALiPER program, http://www.netl.doe.gov/ssl/comm_testing.htm

More cause for concern is the fact that the manufacturer literature for all four LED replacement products significantly overstated their performance for light output and efficacy. In addition, the correlated color temperature for three of the LED products was entirely different than stated in product literature, and two products measured well over 6,000K (very blue in appearance compared to conventional fluorescent). These results indicate that—contrary to manufacturer claims—LED T8 replacements are not yet competitive with linear fluorescent lamps in terms of output, efficacy or color quality.

TRUTH IN ADVERTISING

Many recognize that CALiPER testing has already had a strong impact on industry awareness and has prompted noticeable improvement in product literature. But a growing number of SSL quality advocates share the DOE's concern that poor products (or misrepresented products) may discourage early adopters and significantly delay SSL market penetration. A new DOE initiative called SSL Quality Advocates—jointly developed by the DOE and the Next Generation Lighting Industry Alliance (NGLIA)—is designed to improve the quality of SSL products by defining minimum criteria for reporting product performance and encouraging greater consistency in industry reporting of SSL performance through reference to standards.

This voluntary initiative defines critical performance parameters,



Ten products (including three SSL products) were tested as replacement downlights.

provides labeling recommendations and establishes a pledge program for partners. Participating manufacturers agree to follow the reporting and labeling recommendations, while participating partners—buyers, contractors, lighting designers, distributors, retailers, utilities and efficiency organizations—agree to look for and use products that bear the label. The SSL Quality Advocates initiative was launched in July at the DOE SSL Market Introduction Workshop; learn more about how to participate at www.netl.doe.gov/ssl/qualityadvocates.html.

PROMISING APPLICATIONS

Round 5 CALiPER testing also highlighted some promising applications for LED replacement products, including a series of tests on replacement or retrofit downlights. In side-by-side in situ testing, 10 products were evaluated: three SSL products (one retrofit, one PAR30, one PAR38), a reflector CFL (RCFL), a spiral CFL, a cold-cathode CFL (CCFL), a halogen infrared (HIR), a reflector incandescent (R30), a name-brand, soft white incandescent A19 and a value-brand, frosted incandescent

A19. The **CALiPER Facts Box** below provides a quick snapshot of the results, revealing that some LED downlights can effectively compete with CFL sources. Also noteworthy is that the SSL retrofit and SSL PAR30 test results met or exceeded the manufacturer performance claims.

Another promising application tested in Round 5 is a 2-ft x 2-ft downlight panel, which achieved an efficacy comparable to the T12 fluorescent lamp tested, and a light output close to that of the 2-lamp T8 troffer tested. Although these integrated panel replacements are not strictly “replacement lamps,” test results to date show great promise for general lighting applications with zero-plenum or drop ceilings.

For more details on CALiPER results, download the quarterly Summary Reports or detailed test reports at www.netl.doe.gov/ssl/comm_testing.htm. Recent results and analysis—covering LED MR16 and A-lamp replacements and more—are available for download.

James Brodrick is the lighting program manager for the U.S. Department of Energy, Building Technologies Program. The Department's national strategy to guide high-efficiency, high-performance solid-state lighting products from laboratory to market draws on key partnerships with the lighting industry, research community, standards organizations, energy efficiency programs, utilities and many other voices for efficiency.